Ohmega Ω Resistivity Meter

USER'S MANUAL

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allied Associates
GEOPHYSICAL LIMITED

WARRANTY

1. Allied Associates Geophysical Ltd (AAGL) products are fully tested in our workshop both during construction and after completion and are dispatched in full working condition. Instruments are guaranteed for 12 months from the date of dispatch from the factory, liability being limited in accordance with clause 9 of the General Conditions for the Supply of Plant and Machinery for Export (UN Economic Commission for Europe, Geneva, 1953).

2. When unpacking, please check the contents against the packing list and inspect for damage and malfunction of any kind. In the case of any defect, inform the carrier immediately and report in full to AAGL or their local agent the extent of the damage. Await their reply before taking any further action, except in exceptional circumstances.

3. Should a fault be identified that cannot be remedied on site within the guaranteed period, consult with AAGL. Normal procedure will be to return the unit (or complete system if necessary), carriage paid, to AAGL for inspection and repair or replacement free of charge, provided the fault has not been due to misuse.

4. As far as possible use original case and packaging material for return of the instrument. Equipment is on occasions subject to very rough handling during transit and AAGL cannot be liable for damage due to faulty packing.

5. It is the responsibility of the customer to notify AAGL or their agent of defect or damage to the equipment within a reasonable time of receipt. We would recommend that any defect or omission should be notified verbally but with written confirmation no more than 72 hours after receipt of the product.

6. AAGL Associates Geophysical Ltd will take all necessary steps to rectify any failure, which is deemed the responsibility of the manufacturer, as quickly as possible.

7. No liability against consequential loss can be accepted under any conditions.

Thank you for purchasing the Allied Ohmega Ω Resistivity Meter.

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Printed in Great Britain

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1. GENERAL DESCRIPTION OF THE SYSTEM

1.1. THE OHMEGA Ω

The OHMEGA Ω is a high quality portable earth resistance meter capable of accurate measurement over a wide range of conditions. We have seen large numbers of our instruments sold into countries with challenging climates and harsh conditions such as Chili, Costa Rica, Nigeria, and Ethiopia. The Ohmega has performed well in conditions which on occasions exceed 45 degrees Celsius.

It has a maximum power output of 36 watts, manual selection of current in steps up to 200 mA, a choice of sample time / signal length averaged and three frequency settings. The receiver incorporates automatic gain steps, which provide a range of measurements from 0.001Ω to 360kΩ

The instrument is powered by a large capacity internal rechargeable battery providing several days of use without recharging in average terrain conditions. External power can be by way of any 12 VDc source, the most common type being a vehicle battery (with caution as some trucks use 24VDc). The OHMEGA Ω is housed in an impact-resistant Peli Case, the case benefits form a lifetime guarantee so broken handles, catches etc will be replaced should these become defective/damaged.

The OHMEGA Ω is designed for ease of use however simple but strong design principals have been employed to ensure our product is engineered to exceptional standards. Designed and built by instrument engineers we have employed the best construction methods required to ensure the Ohmega will offer quality and extended service over many years.

2. THE ALLIED OHMEGA Ω

2.1 CONSTRUCTION

The OHMEGA Ω is housed in a high impact-resistant Peli case and is fully water-tight, 30 minutes @ 1m, and has an IP rating of 67. The Peli case enjoys a lifetime guarantee so broken handles, catches etc will be replaced free of charge. The various electronics circuits and switching relays are mounted below the front panel. The transmitter/receiver control buttons and LCD display occupy the full area of the instrument front panel. Apart from occasional accidental damage to PI P2 C1 C2 connectors or the on/off you should not experience any defects to the instrument. Corrosion due to water damage (common with geophysical equipment) is possible over a sustained period of time when operating in adverse wet weather. It is essential therefore that excess water is removed and prevented for remaining on the instrument where possible. Such procedures will reduce failure and ultimately reduce maintenance costs.

The Ohmega Ω is supplied with 4 stainless steel electrodes, 2 x 500m & 2 x 250m cables on lightweight reels, and a battery charger. A resistor test box is included allowing instrument checking against a known reference value.

2.2 THE CONTROLS AND CONNECTORS

Fig.2. The OHMEGA Ω front panel showing Operation Buttons

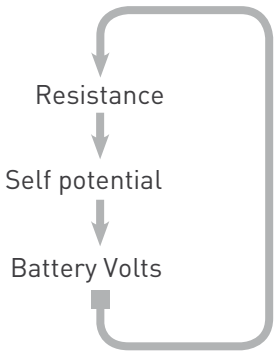
All the external controls, together with the liquid crystal display are situated on the top front panel of the instrument. They are fully weather-proof. The controls are shown in Figure 2 and are described below. In addition to the "ON/OFF" switch and the "GO" or measurement button, there are three other buttons marked mA, Mode and Cycles controlling functions as outlined below.

2.2.1 ON – OFF

Used to switch the instrument on or to switch the instrument off. A blue neon light is fitted to indicate when the instrument is powered on.

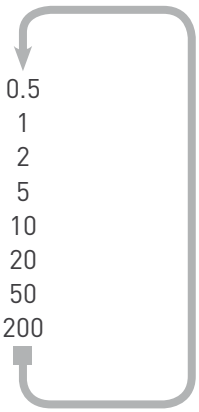
2.2.2 MODE

The button marked MODE selects the type of measurement. The display will indicate the following sequence of options as appropriate.



mA (Current)

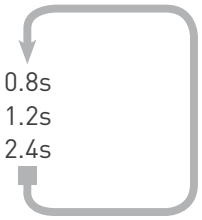
The button marked mA is used to select the desired current in milli-amps. The current is increased each time the button is pressed in the following steps:



The current value selected is indicated on the display.

2.2.3 SAMPLE TIME

If the MODE and mA buttons are pressed simultaneously the sample time (or signal length) can be changed as shown below:



2.2.4 NUMBER OF CYCLES

The button marked Cycles selects the number of readings to be averaged. This can be from 1 to 16. Details of how the signal is processed to obtain a single measurement of ground resistance are given in Section 2.4. of this manual.

2.2.5 GO

Press this button to start measuring with the previously set parameters.

2.2.6 APLHA-NUMERIC DISPLAY

The 80-character (4x20) liquid crystal display indicates the parameters selected and the measurement details as the survey progresses. See Figure 3. The display can be backlit by pressing Mode and Cycles simultaneously. The light automatically switches off after one minute if no activity is sensed during this time.

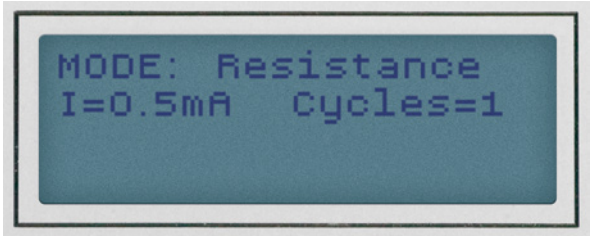


Fig.3. Ohmega Ω Display and Electrode Terminals

2.2.7 EXTERNAL POWER SUPPLY

An external 12V power supply may be connected through the socket Chrg/Ext. A connecting lead is supplied for this purpose. It is important to remember the correct polarity when connecting to an external supply.

WARNING!
Do not connect to a car battery while it is being charged!

2.2.8 MANUAL CONTROL

The red and black coloured current and potential terminals marked P1, P2, C1, C2, are situated on the front panel – See Figure 2. Single core cables are connected to these terminals for measuring earth resistance. The Ohmega is supplied with jumper cables to connect P & C terminals to the cable reels.

2.3 MAKING MEASUREMENTS

1. Check that the instrument is correctly connected to the current and potential cables with the jumper cables supplied. Ensure a good connection is made with the electrodes.
2. Switch on the Ohmega. Display shows

```
MODE: Resistance
1=0.5mA Cycles=1
```

3. Check battery volts. (activate Mode switch twice and press GO) If the battery is below the operating voltage the display will read

```
BATTERY LOW
Charge battery or switch
to external power
```

4. If the external temperature is above 40°C or below 0°C, take steps to bring the temperature within the operating range. Whilst the instrument will operate above and below these temperatures you may notice unstable readings.

5. Check the Self Potential voltage. Use the MODE switch to put the instrument into the SP mode (activate MODE switch once). Make a few measurements to see how it is varying by pressing the GO switch and noting the results obtained. The amplitude and rate of change of the SP will affect the readings at low resistance values and determine the instrument settings required to optimise accuracy.

6. A current setting will be required to meet the electrode separation and ground conditions. If ground conditions are such that the instrument cannot deliver the required current or there is an open circuit (damaged cable/connection). When the GO button is pressed the display will read

```
CURRENT ERROR
Check Electrodes
```

   To overcome this problem decrease the current and/or water the electrodes to improve ground contact.

   Repeat item 6 above to ensure systems is correctly set.

7. Select the number of readings to be averaged using the Cycles button. This will depend to a great extent on ground noise. Start with 4 readings and increase or decrease depending on the consistency of the readings obtained.

8. Select Resistance and press the GO button. The display will initially indicate the voltage gain being used in the measurement.

```
..Setting Gain
G=5   I=2mA   N = 3
```

   G=5 indicates the amplifier gain setting. These are x5, x0.5, x0.05 and x0.005. In a noisy environment, high and varying SP values may cause the amplifier to saturate during the averaging. The display will show

```
GAIN ERROR
Change Current
```

   In this case, reduce the current to bring the signal within the operating range.

   The display will then indicate the successive averages of the resistance, bleeping each time during the process. At the standard setting the instrument takes 2.1s to complete a set of 4 readings. The resulting resistance value will show with a decimal point followed by Ω or KΩ. If the potential and current connections have been incorrectly connected a negative sign will precede the digits. This can also be due to ground conditions.

2.4 THE SIGNAL

The transmitter uses commutated DC to produce the signal shown in Fig. 4 (a).

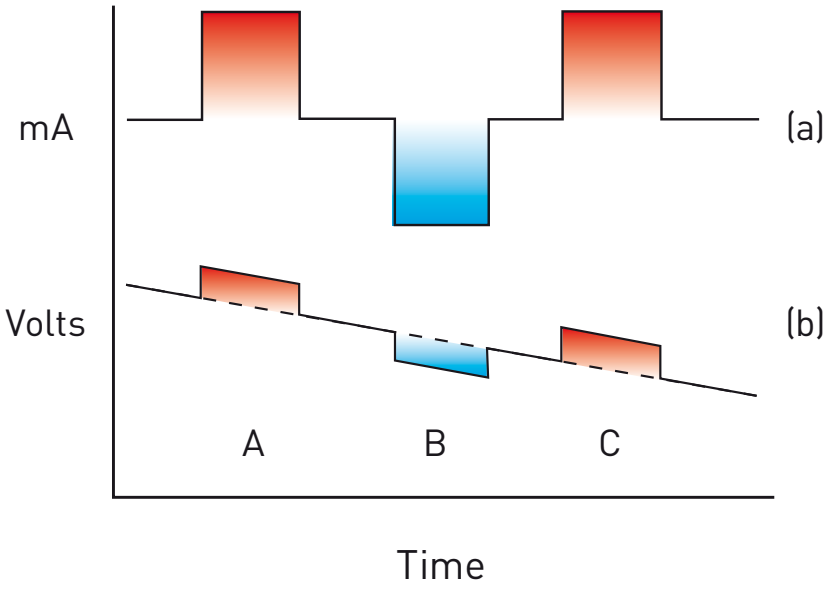


Fig. 4. The OHMEGA Ω SIGNAL (a) Transmitted signal (variable Periodicity), (b) Received signal. Here the attenuated and modified signal is superimposed on slowly varying earth currents. It is sampled over times A, B and C.

The on period is sampled for only the last 4/5 of the on time e.g. 0.8s in 1.0s.

An example of the received signal in the presence of electrical ground noise is shown in Figure 4 (b). This figure also illustrates the processing technique used to extract a value of the required potential difference from the received signal, here shown superimposed on a slowly varying earth current. The signal is digitally sampled over times A, B and C and the amplitude calculated as (Va+Vc–2Vb)/4). The on/off ratio is 2.5:1 and the sample/un-sampled ratio during any "ON" period is 4:1. This is to allow any coupling and IP affects to die away before sampling takes place.

When a number of cycles are averaged the microprocessor calculates the potential difference from successive sets of three "ON" periods, ABC, BCD, CDE, giving values (Va+Vc–2Vb)/4, (Vb+Vd–2Vc)/4, etc.

When conditions are adverse, e.g. a low signal/ground noise ratio, apparent as a lack of consistency in the readings, use higher current settings that do not cause a "GAIN ERROR" and average over 16 cycles. Gain errors are usually due to sudden increases in ground noise saturating the system. If the area is generally very noisy it may be necessary to operate at the longest cycling time. In extreme conditions, i.e. measuring very low resistances against a background of large amplitude and varying SP, highly inconsistent readings may be obtained.

2.5 POWER SUPPLY

The Ohmega O uses sealed gel-cell batteries (7 AH at 12V). Under average working conditions (e.g. 10 offset soundings per day at 5mA) recharging every 2 working days would be safe practice. Whilst many more readings can be accommodated, the combination of cycles selected and sampling time, with different selected currents will have an impact on the total number of reading per day from a fully charged battery.

Should it be necessary to be away from a mains power source for more than a few days the instrument can be operated using an external supply. A 12V car battery which can be recharged from a vehicle can be used in an emergency. A separate lead is supplied which can be clipped onto the battery. Be sure to check the polarity before connecting to the instrument.

WARNING!
Do not run the vehicle engine while the instrument is connected to the battery as transients from the alternator can damage the transmitter circuitry.

2.6 BATTERY CHARGER

This operates from 240V or 115VAC. The maximum current output is such that batteries can be left on indefinitely without suffering any damage. Charging time from full discharge is 9 hours. If storing the Ohmega O for a long period of time, recharge the battery every month. Failure to do so will result in irreversible damage to the battery and reduce its operation time. If this does occur the internal batteries will need to be replaced.

NOTE: if the meter is operated while the battery is being charged, the charger is automatically disconnected.

2.7 TROUBLESHOOTING GUIDE

This trouble shooting guide assumes the instrument is switched on.

Our design and construction of the Ohmega is such that mechanical failures are mostly due to accidental handling in rough environments. It is highly recommended that visual inspection is carried out to the entire systems and cables on a regular basis and preventative maintenance carried out when minor problems are identified.

Electronic failure by its very nature will in most cases require that the meter needs to be returned for repair, test and calibration. However before such action is implemented a few basis checks can be performed to identify the possible cause of the problem and the action required to rectify the fault. The following guide offers basis tests to assist with fault finding.

No LCD display (Blue neon off)	Check fuse, Check battery, Run on external power source. If fault still remains, return for repair
CC Error	Check instrument with test resistor box. If reading ok, check jumper cables, check long resistance cables. Check meter settings (mA selection). If reading from Test box is not correct return meter for repair
Readings erratic	Check instrument with test resistor box. If reading correct, check cabling/water electrodes. If reading incorrect, return meter for repair.
Battery will not hold charge	Normal indication that batteries need replacing or charger defective. Use external power or return with charger for repair.

If the above checks indicate that the meter needs to be returned for repair please include a brief fault indication with the meter advising us of the problems you are experiencing.

3. ALLIED OHMEGA Ω SPECIFICATIONS

TRANSMITTER	
Maximum power output:	36W
Current range:	0.5mA to 200 mA
Square wave repetition:	8.4s, 4.2s. 2.8s.
Number of readings averaged:	1 to 16.
RECEIVER	
Input voltage range:	0 –180V with auto gain averaging.
Input impedance:	22MO
Measurement range:	0.001O - 360KO Low pass filter
Display:	80 character alphanumeric liquid crystal
Power supply:	Rechargeable sealed gel-cell. 7 AH @ 12V
Battery life (standby):	36 Hours continuous
GENERAL	
Weight Instrument:	6kg
Electrode capacity:	2 Current, 2 Potential
Shipping weight with cables:	34Kg

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4. CERTIFICATES OF CONFORMITY

Product: ALLIED OHMEGA Ω earth resistance meter

EMC 89/336/EEC Generic EN50081/1 Light Industrial Emissions,
EN50082/1 Light Industrial Immunity

Tests Applied

BSEN 55011 Class B Radiated Emissions
BSEN 61000-4-4 Fast Burst Transients to Level 2 Light Industrial
BSEN 61000-4-2 Static Discharge to Level 2 Light Industrial

Category 3 PASS

BSEN 55011 Class B Conducted Emissions: N/A – battery only
Low Voltage Directive 73/23/EEC: N/A below 50V AC.
Machinery Directive 98/37/EEC: N/A – no moving parts.

Product: Charger for ALLIED OHMEGA Ω earth resistance meter

Tests Applied – Electrical Safety

BS EN55014, BS EN61000, BS EN60335

We, on behalf of Allied Associates Geophysical Ltd., confirm the product described above meets the requirement in all respects.

Serial No: ..... Date of Shipment: .....

Signed: ..... Authorised Signatory: .....

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USER MANUAL COMMENTS SHEET

Please note on a copy of this form any suggestions for improvement or any errors found in this manual.
Please return the form to:

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